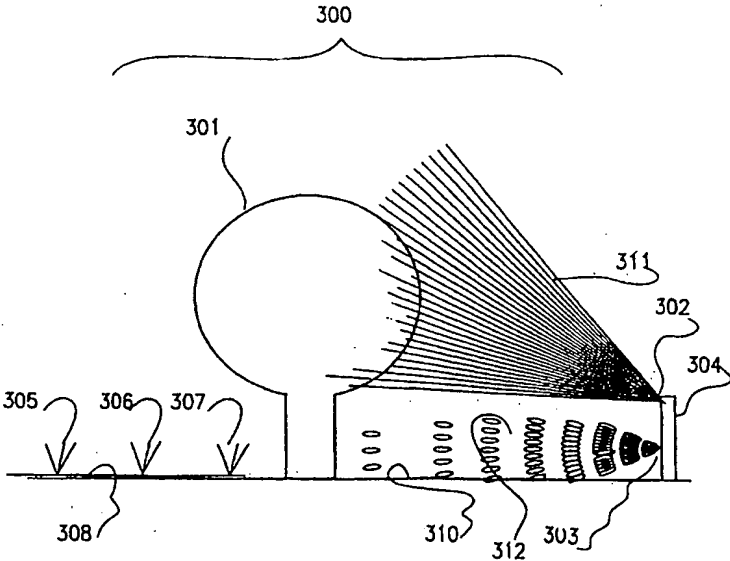


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top; padding: 5px;"> <p>(21) International Application Number: PCT/NZ94/00138</p> <p>(22) International Filing Date: 5 December 1994 (05.12.94)</p> <p>(30) Priority Data: 250485                      16 December 1993 (16.12.93)      NZ</p> <p>(71) Applicant (for all designated States except US): WAIPUNA INTERNATIONAL LIMITED [NZ/NZ]; 7th floor, Downtown House, QEII Square, 21-29 Queen Street, Auckland 1001 (NZ).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): TINDALL, Dennis, Walter [NZ/NZ]; 96 Walmsley Road, Mangere, Auckland 1701 (NZ).</p> <p>(74) Agents: PIPER, James, William; James W. Piper &amp; Co., 46 Brown Street, Ponsonby, Auckland 1002 (NZ) et al.</p> </td> <td style="width: 50%; vertical-align: top; padding: 5px;"> <p>(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ).</p> <p><b>Published</b> With international search report.</p> </td> </tr> </table>			<p>(21) International Application Number: PCT/NZ94/00138</p> <p>(22) International Filing Date: 5 December 1994 (05.12.94)</p> <p>(30) Priority Data: 250485                      16 December 1993 (16.12.93)      NZ</p> <p>(71) Applicant (for all designated States except US): WAIPUNA INTERNATIONAL LIMITED [NZ/NZ]; 7th floor, Downtown House, QEII Square, 21-29 Queen Street, Auckland 1001 (NZ).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): TINDALL, Dennis, Walter [NZ/NZ]; 96 Walmsley Road, Mangere, Auckland 1701 (NZ).</p> <p>(74) Agents: PIPER, James, William; James W. Piper &amp; Co., 46 Brown Street, Ponsonby, Auckland 1002 (NZ) et al.</p>	<p>(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ).</p> <p><b>Published</b> With international search report.</p>
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<p>(54) Title: RETICULATION MEANS</p> <div style="text-align: center; margin: 20px 0;">  </div>				
<p>(57) Abstract</p> <p>Reticulation means for the reticulation about an area of one or more liquids such as cold water, warm water, hot water up to 180 degrees C or water containing pesticide, herbicide or the like by means of pipes (308) radiating either singly or in pairs from a supply site to a distribution point (304, 305). Thus more than one liquid may be passed through a pipe at different times or through a pair of pipes at the same or different times. Each distribution point may be provided with two or more nozzles. The upper nozzles (304) are suitable for upwards spraying of a fine spray (311) which can be cold water or pesticide to control insects on foliage (301) or warm water to combat frost. The lower nozzles (303, 305, 306, 307) spray cold water low down for irrigation purposes, or herbicide or hot water globules (312) or a mixture of hot water and steam for weed control.</p>				

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**RETICULATION MEANS**

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**FIELD OF THE INVENTION**

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This invention relates to the field of horticulture, more particularly to reticulation of liquids around an area used for horticulture and the like, and also to automated application of liquids for irrigation, the control and management of pests, weeds, frost damage, and the like.

**BACKGROUND**

Some of the problems faced by horticulturists include:

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frost damage, irrigation, pest control, weed control, soil sterilisation, and fertiliser application.

25

In order to deal with these problems it is generally necessary to provide space-consuming tractor/trailer access alongside each row of plants or trees grown. Other problems include the cost and availability of labour (especially for frost damage control).

"Horticulture" includes market gardening, orchard management, growing edible plants, grapes, and the like.

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Furthermore there is a trend nowadays to provide controlled atmospheres inside glasshouses (the term including plastic tents and the like) and as some preferred atmospheres are high in carbon dioxide, it is difficult to carry out manual labour within glasshouses.

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Accordingly there is a need to at least partially automate procedures to distribute liquids used to control frost damage, or to provide irrigation, pest control, weed control, soil

- 2 -

sterilisation, and the like.

## OBJECT

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It is an object of the present invention to provide an improved system for the reticulation, supply and control of liquid services about an area of land or one which will at least provide the public with a useful choice.

## STATEMENT OF THE INVENTION

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According to one aspect of the present invention there is provided reticulation means for the reticulation about an area of one or more liquids by means of lines including one or more pipes from at least one supply site to one or more distribution points, characterised in that more than one liquid may be passed through a pipe at different times, and each distribution point provides one or more nozzles for the deliver of one or more liquids in one or more preset directions.

15

Preferably the reticulation means includes at least two pipes from one supply site to one distribution point, whereby a different liquid may pass through one of said pipes reserved for that liquid.

20

Conveniently the pipes are constructed of a metal, or a plastics material, or metal coated internally and/or externally with a plastics material.

Advantageously the external coating is adapted to serve as thermal insulation.

25

Preferably the diameters of the pipes provided are larger nearer the or each source, where the flow rates are higher so that the material and the internal capacity is at least partially optimised with respect to pressure and delivery.

30

Conveniently the system of pipes includes pipe flushing mechanism whereby remaining traces of liquids containing additives or heated liquids may be flushed away before the system is used to distribute another type of liquid.

Preferably there is a return line from the distribution point to the supply site whereby excess liquid can be returned to a flushing tank.

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- 3 -

Advantageously there is provided an actuator connected to one of said nozzles, said actuator being adapted to alter the flow through the nozzle.

5 Preferably the actuator is adapted to open or close the flow of liquid through said nozzle.

There may be a remote controller connected to operate said actuator.

10 Conveniently the actuator is driven electrically or by pneumatic or hydraulic means.

According to another aspect of the invention there provided a reticulation system, including any of the above mentioned reticulation means.

15 Preferably there is provided a supply site to which the reticulation means is connected, and including a source of water under pressure.

Conveniently there is provided means to heat the water, optionally capable of warming the water or heating it up to a temperature in the range of from about 30 to about 180 degrees C.

20 There may be means to controllably mix one or more additives into the water from time to time; the additives including but not being limited to: growth promoting agents, fertilisers or trace elements, insecticides, herbicides, fungicides, or soil sterilising agents.

25 Preferably there is provided a temperature sensor connected to control means adapted to send warm water along said pipe when the temperature at the sensor falls below a predetermined value.

30 Advantageously the nozzle connected to said pipe is adapted to project a fine spray of the warm water. The nozzle may be adapted to direct the spray in the direction of foliage to be protected from frost damage.

Conveniently the control means is located remote from the supply site.

35 Preferably there is provided a plurality of said temperature sensors and in which the control means is adapted to distribute the warm water to selected parts of said area.

- 4 -

Alternatively said nozzle may be adapted to project a spray of water globules or water globules and steam, for example towards the ground.

5 Preferably a first and a second of said nozzles are provided at one distribution point, said first and second nozzles being connected to and fed by a single pipe and including selector means whereby a selected one of said first and second nozzles is rendered inoperative and the other is operative and vice versa.

10 Said first nozzle may be adapted to project a fine spray, for example in the direction of foliage.

Advantageously said second nozzle is adapted to project a spray of water globules or water globules and steam, for example towards the ground.

15 Conveniently there may be provided a ground moisture detection means connected to control the flow of irrigation water through said pipes to the distribution points.

20 Furthermore, the reticulation system may include means to detect a blockage of one or more of said nozzles and to convey the information about said blockage to a supervisory station.

The water may be pressurised to a pressure such that it does not boil at a temperature of around 180 degrees C.

25 Preferably any pipe used to carry a liquid is effectively thermally insulated.

There may be provided reheating means for the water located downstream of said means to heat the water.

30 According to a further aspect of the invention there is provided a method of warming an area of vegetation or cultivation including the steps of utilising an above mentioned reticulation system over said area and passing warm water through said pipes and nozzles.

35 According to another aspect of the invention there is provided a method of controlling vegetation on an area of vegetation or cultivation including the steps of utilizing any of the above mentioned reticulation systems and passing hot water through said pipes and nozzles so as to project a spray of hot water globules or hot water and steam onto the

- 5 -

vegetation to be controlled.

5 According to yet another aspect of the present invention there is provided a method of controlling pests on an area of vegetation or cultivation including the steps of utilizing one of the above mentioned reticulation systems and passing water or water including a pesticide through said pipes and nozzles so as to project a spray of the water or water and pesticide over the area.

10 Preferably the water or water and pesticide is projected from the nozzles as a fine spray.

Advantageously the nozzles are adapted to project the spray in the direction of foliage on which the pests are to be controlled.

15 Conveniently the pesticide is projected from the nozzles as a spray of water globules.

Preferably the nozzles are adapted to project the spray of water globules towards the ground.

20 According to a further aspect of the present invention there is provided a method of sterilising an area of soil including the steps of utilising one of the above mentioned reticulation systems and passing water at a temperature between around 100 degrees C and 180 degrees C through said pipes and into or onto the area of soil.

25 According to yet another aspect of the present invention there is provided an enclosed space in which vegetation is cultivated, said space being filled with an atmosphere enriched with a gas beneficial to the vegetation in said space and, within said space, one of the above mentioned reticulation systems.

Conveniently the atmosphere is enriched with carbon dioxide.

### 30 DRAWINGS

The following is a description of a preferred form of the invention, given by way of example only, with reference to the accompanying diagrams.

35 Fig 1: is a plan of an area of land provided with liquid reticulation and control means according to this invention.

- 6 -

Fig 2: illustrates details of an embodiment of the present invention - including spray patterns in plan view.

5 Fig 3: illustrates details of an embodiment of the present invention - including spray patterns in side view.

### PREFERRED EMBODIMENT

10 The invention comprises a system for the reticulation of water - optionally heated water or water including additives - through distribution pipe systems from a central water-heating means and about an area of land 100 holding vegetation (108, 109, 203, 301) farmed for horticultural objectives, in order to provide cold water, warm water, or hot water optionally containing additives for applications such as weed control, pest control, soil sterilisation, frost protection, or irrigation.

15 The distribution pipes (103, 104, 105, 106, 107) originate at one or more supply stations (102) and are provided with one or a number of distribution nozzles, preferably in arrays 304, at which the liquid contents of the feeder pipe may be dispensed in various formats. Each nozzle or nozzle array is activated by (for example) a remotely driven actuator. Some or all of the pipes may be insulated. Preferably all of the pipes are  
20 insulated where the system is to be used with hot water, or where frozen ground may be encountered.

25 Preferably large-bore pipes are provided where flow rates are high, so that the pressure drop is minimal and the nozzles are provided with liquids at an adequate pressure. (This is analogous to the human arterial blood supply system, with the largest vessels closest to the heart.)

30 Pipes should be made of a corrosion-resistant material such as stainless steel. Alternatively they may be made of a suitable plastics material, taking due account of the possibility that hot, high-pressure water may be carried by at least some of the pipes. These may be reinforced by a mesh, or by a metal outer layer. Alternatively a steel pipe may be protected by an inner layer of a plastics material.

35 It is possible to provide a line of pipes, rather than a single pipe, and dedicate some at least of the pipes to the carriage of particular fluids.



- 7 -

5 As an example, in the irrigation mode nozzles such as 204, or 305, 306, 307, lying along a sub-distribution pipe such as 110 or 308, are connected to the distribution pipes by means of a remotely controllable control valve and might for example be directed so as to wet the soil 310 about the roots of a tree 301 with unheated water fed through the pipes.

10 In the frost protection mode nozzles such as 205, 206, 302 might be connected to the distribution pipes which for the purpose are filled with cold or warm water at a temperature not likely to cause any damage to the trees (or the like). A similar nozzle (perhaps aimed lower) would be used for grape vines and in that case might be used from time to time to spray a fungicide onto the foliage.

15 In the weed-killing mode, nozzles 207, 211 or 303 which are directed at the ground would be connected to the pipes which had already been charged with water at a high temperature. The control station 102 is preferably provided with a boiler capable of raising the water fed into the pipes to a high temperature, for example 180 degrees C, so that when it is released onto the ground 310 it retains a temperature of the order of 100-105 degrees C and is thereby an effective herbicide.

20 For example, a variety of types of application outlet, having various remotely controlled valves at each outlet, could be used so that the same pipe and outlet system can be used for a number of purposes. Instances of these include irrigation - where a fine spray 311 of unheated liquid may be directed at the leaves, weed control, where a "thick" spray 312 of mixed water globules and steam (at around 95-105 deg C at the orifice) may be directed at the ground, or frost control, where a fine spray 311 of warm water may be directed at the leaves. Soil sterilisation with steam is another application requiring a further placement of valves and distribution pipes (not shown). For such purposes a large number of outlet arrays may be provided so that the operations under consideration can be entirely automatic and may for example be controlled by a computer at a central control station, together with communications lines (wired or wireless) and actuators on the different valves.

30 Preferably means (not shown) are provided to prove that an actuated nozzle is actually emitting liquid, and if a fault such as a blockage is detected (for example by use of an infra-red beam across each nozzle outlet) to immediately alert a person or device at the control station or at the nearest supervised place (such as an orchardist's home).

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- 8 -

5 One computer-compatible arrangement where a large number of nozzle arrays is involved is to allocate unique addresses to the controller adjacent to each nozzle array, and to use a serial data line such as the RS-422, CANBUS, or the like to pass instructions in either direction. A signalling protocol such as that used in the I<sup>2</sup>C bus might be used.

The control station itself may be adjacent to the boiler etc (102) or may be at a further site such as in the orchardist's office or home.

10 This system with control means incorporated leads to the provision of an automatic irrigation and frost control system having the options of weed control, insect control, soil sterilisation, and the like. There may be sensors at one or more places about the serviced area, capable of responding to soil or plant dryness - in which case the system goes into an irrigation mode, either locally or over the whole area, capable of  
15 responding to coldness, in which case the system may be programmed to go into its frost control mode, and possibly insect detectors of various sorts (such as microphones, interruptible light beams, etc) may be provided which cause the system to enter an insecticidal mode of operation. Since the response is substantially immediate, the actual insecticide used may be a relatively mild substance as it may be sufficient to interfere with the insect egg-laying process rather than kill a large biomass of larvae.

20 Preferably the bases of fixed plants -such as fruit trees or vines - would be provided with shields to protect them from the use of herbicidal treatments especially the hot water.

25 Other options include the delivery of insecticides or herbicides through the same pipe, although in the case of at least some of these agents, it may be preferable to use an entirely separate distribution system in order to avoid undesirable contamination. This problem can be overcome by other means such as the provision of a pipe-flushing mode in which any remaining herbicide or the like is returned or pushed forwards, bypassing  
30 all application outlets and going to a holding tank or other disposal unit.

In order to maintain this temperature it may be necessary to provide supplementary heating means along the distribution pipes. This may be concentrated at particular sites or distributed along the pipes for example as heating tapes, and it may be useful to use the heating tapes as means to prevent the water inside the pipes from freezing and  
35 thereby damaging the installation.

- 9 -

5      Optionally the system can be used in enclosed spaces used primarily for horticulture such as glasshouses or the plastic equivalents. This invention is applicable to installations where labour is restricted, perhaps for reasons of cost or perhaps because plants are being grown in a substantially sealed environment (for example tomato plant growth is believed to be enhanced in conditions high in carbon dioxide though it is difficult and/or unsafe for a human to work inside such an environment for reasons of incompatibility with human respiration).

10      One purpose of this preferred form of the invention is to provide an automatic or semi-automatic provision of water for irrigation, frost damage prevention, or the like, wherein a central processor - a computer for example - is set up to continuously monitor data from a number of sensors which may include temperature sensors, humidity sensors, soil moisture sensors and the like, and if intolerable conditions are sensed (such as low air temperatures) the computer automatically initiates and maintains a  
15      suitable treatment action until such time as the hazard has been controlled.

20      This action may be local; that is, in order to avoid waste the pipe system may be functionally partitioned into more than one activation zones, each one being separately controllable so that warm water or irrigation water is applied only when and where it is needed.

25      Heated water - particular water at or about the boiling point of water - is usable as a defoliant or herbicide and has the advantage that once it has lost its elevated temperature it is simply water; there are no residues to contaminate the possibly sealed environment. It has been found that a mixture of hot water and steam applied to the ground is an effective weed-killing treatment. Accordingly one version of the invention includes means to provide a supply of water at a high temperature suitable for herbicidal purposes.

    Alternatively the pipes may be used to carry steam for the purpose of soil sterilisation.

30      Optionally the same pipes may be used for carrying unheated water for irrigation purposes and at another time for carrying heated water for specific purposes, and optionally the pipes can at other times be used for water containing additives such as insecticides or fertilisers or the like.

35      In order to clear the pipes of excess liquid, such as water that has cooled, return pipes may be provided to bleed off excess liquid to holding tanks or to recycle the liquids.

- 10 -

Advantages of this system include:

- 5 1. Automation of many watering, spraying, and herbicidal operations around a horticultural area,
2. Minimising herbicidal residues,
3. Automatic detection of and rapid optionally localised response to some hazards (such as frost),
4. Minimising the need for motorised vehicles about the property,
- 10 5. Possibility of providing high-CO<sub>2</sub> environments in enclosed spaces for enhanced plant growth while substantially reducing the human entry requirement.

It has been found that water on its own, whether heated or not, is often very effective in insect control when applied through this system by projecting the water upwards under leaves when insect populations normally breed.

15 For example, most fruit insects do not survive when continually sprayed with water. It is advantageous, during the adult life cycle of the insects, to turn the water on and off 20 or more times each day, to project a fine mist up from the ground. This enables little or no pesticide to be used.

20 Finally, it will be appreciated that various alterations and modifications may be made to the foregoing without departing from the spirit or scope of this invention.

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## CLAIMS:

- 5 1. Reticulation means for the reticulation about an area of one or more liquids by means of lines including a pipe from a supply site to a distribution point, characterised in that more than one liquid may be passed through a pipe at different times, and that the distribution point provides two or more nozzles for the delivery of one or more liquids in one or more preset directions.
- 10 2. Reticulation means according to claim 1 characterised by actuator means arranged optionally to open or close a selected one of said nozzles at the distribution point.
- 15 3. Reticulation means for the reticulation about an area of one or more liquids by means of lines characterised by at least two pipes from one supply site to one distribution point, whereby a different liquid may pass through one of said pipes reserved for that liquid.
- 20 4. Reticulation means according to claim 1, 2 or 3 characterised in that one said nozzle is adapted to project a fine spray of water in an upwards direction.
- 25 5. Reticulation means, according to any of claims 1 to 4 characterised in that the or another of said nozzles is adapted to project a spray of water globules or water globules and steam in a downwards direction.
- 30 6. Reticulation means according to any of claims 1 to 5 characterised by means to heat the water, optionally capable of warming the water or heating it up to a temperature in the range of from about 30 to about 180 degrees C said water being pressurised to an extent that it will not boil in said pipe.
- 35 7. An enclosed space in which vegetation is cultivated, said space being filled with an atmosphere enriched with a gas beneficial to the vegetation such as carbon dioxide in said space characterised in that there is provided within said space, reticulation means according to any of claims 1 to 6.
8. A method of sterilising an area of soil characterised by the steps of utilising reticulation means according to any of claims 1 to 6 and passing water at a temperature between around 100 degrees C and 180 degrees C through said pipes and into or onto the area of soil.

- 12 -

5 9. A method of controlling vegetation on an area of vegetation or cultivation characterised by the steps of utilizing a reticulation system according to claims 5 or 6 and passing hot water through said pipes and nozzles so as to project a spray of hot water globules or hot water and steam onto the vegetation to be controlled.

10 10. A method of controlling pests on an area of vegetation or cultivation characterised by the steps of utilizing a reticulation system according to any of claims 1 to 6 and passing water either continuously or intermittently through said pipes and nozzles so as to project water over the areas as a fine spray in the direction of foliage, especially the underside of said foliage, on which the pests are to be controlled.

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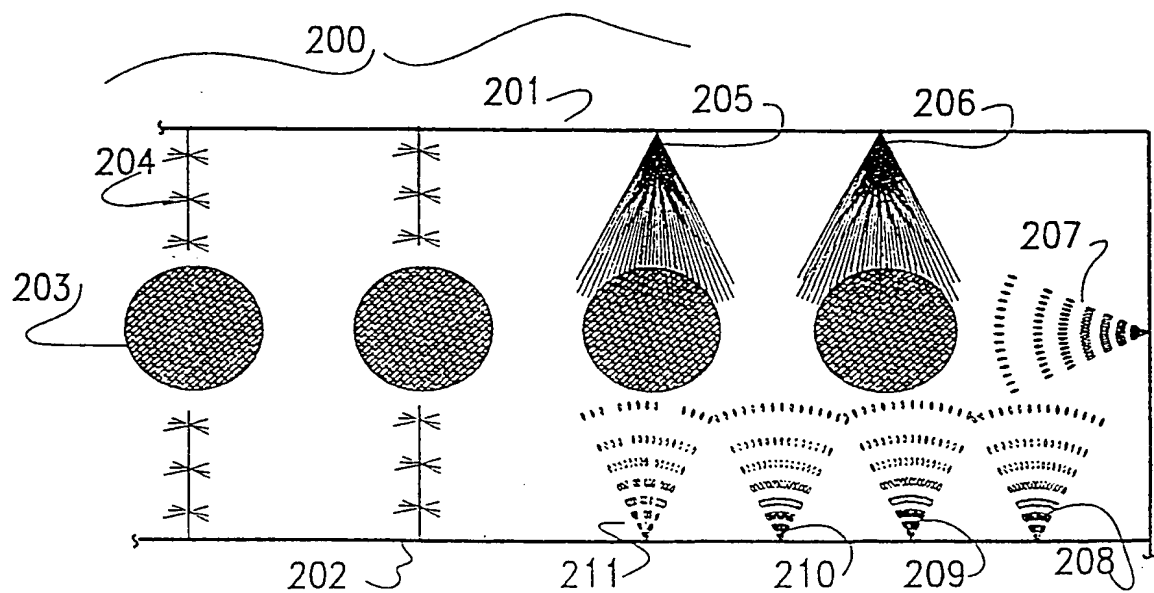
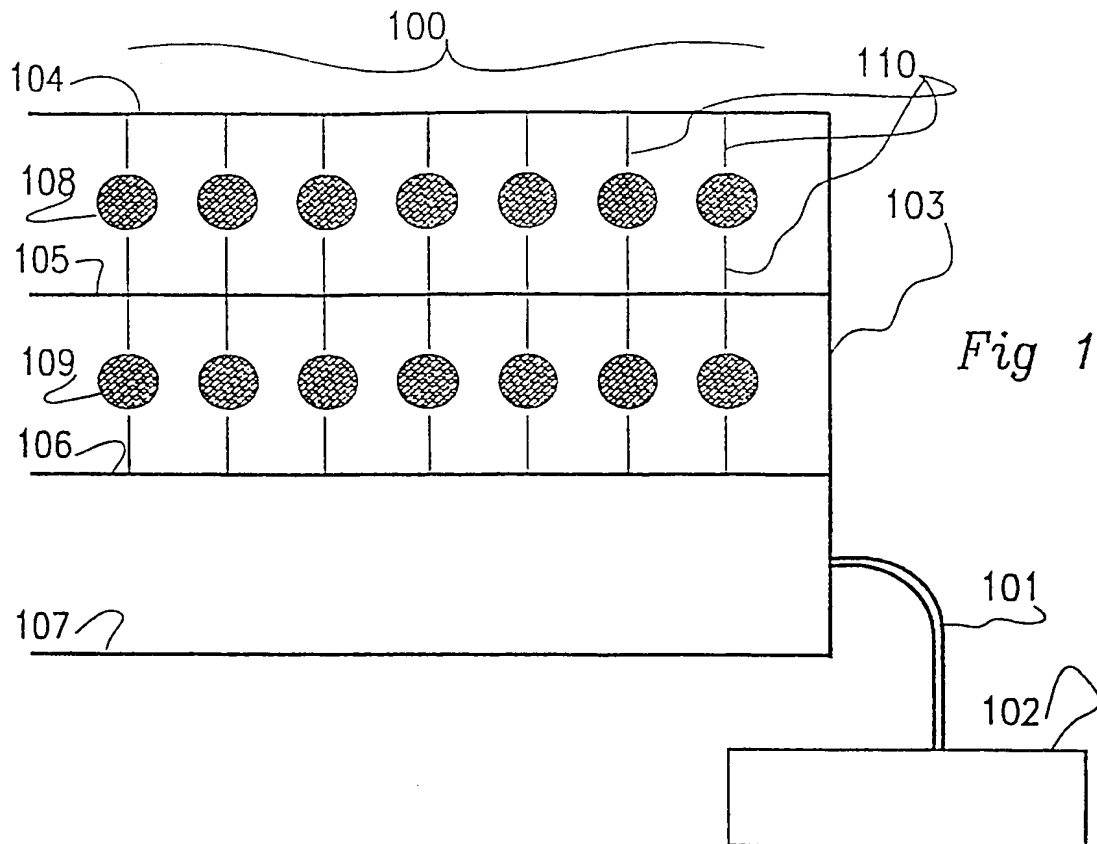
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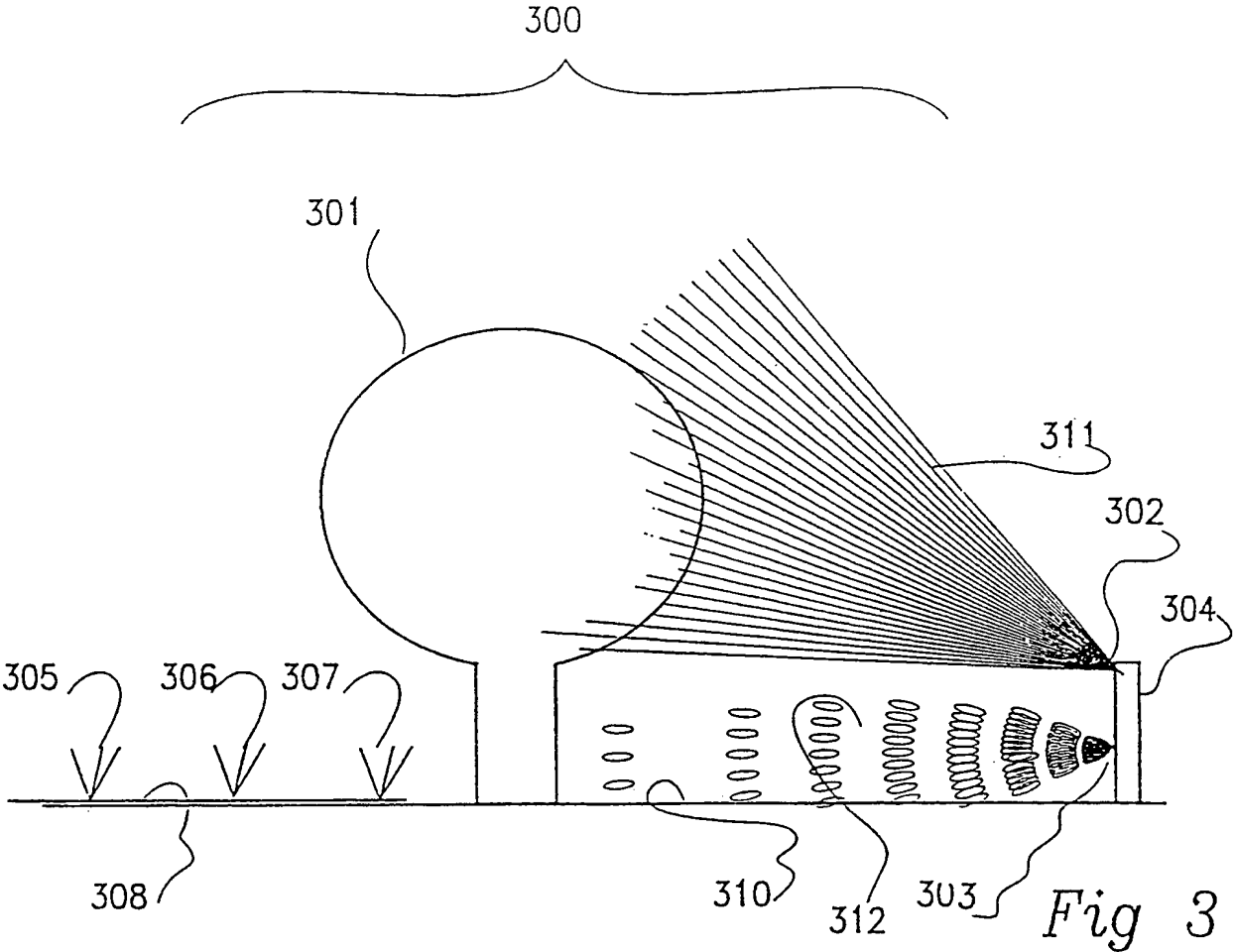
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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ 94/00138

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> Int. Cl. <sup>6</sup> A01G 25/00,11/00,13/06; A01M 19/00,21/04  According to International Patent Classification (IPC) or to both national classification and IPC																						
<b>B. FIELDS SEARCHED</b>  Minimum documentation searched (classification system followed by classification symbols) IPC: A01G 25/00,25/02,11/00,13/06; A01M 19/00,21/04,7/00  Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched AU: IPC as above  Electronic data base consulted during the international search (name of data base, and where practicable, search terms used)																						
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>																						
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.																				
X	AU,A,56204/80 (MOELLER et al) 10 September 1981 (10.09.81) Whole document	1,4,5,6,7,9																				
X	AU,A,48343/85 (DAY) 9 April 1987 (09.04.87) Whole document	1,6,9																				
X	AU,A,81666/91 (YAMADA) 27 February 1992 (27.02.92) Whole document	1,2,3																				
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.																						
<p>* Special categories of cited documents :</p> <table><tr><td>"A"</td><td>document defining the general state of the art which is not considered to be of particular relevance</td><td>"T"</td><td>later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</td></tr><tr><td>"E"</td><td>earlier document but published on or after the international filing date</td><td>"X"</td><td>document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</td></tr><tr><td>"L"</td><td>document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</td><td>"Y"</td><td>document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</td></tr><tr><td>"O"</td><td>document referring to an oral disclosure, use, exhibition or other means</td><td>"&amp;"</td><td>document member of the same patent family</td></tr><tr><td>"P"</td><td>document published prior to the international filing date but later than the priority date claimed</td><td></td><td></td></tr></table>			"A"	document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	"E"	earlier document but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family	"P"	document published prior to the international filing date but later than the priority date claimed		
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"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family																			
"P"	document published prior to the international filing date but later than the priority date claimed																					
Date of the actual completion of the international search 6 March 1995 (06.03.95)		Date of mailing of the international search report 15 Mar 1995 (15.03.95)																				
Name and mailing address of the ISA/AU AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA  Facsimile No. 06 2853929		Authorized officer  R. Kirby  Telephone No. (06) 2832369																				

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ 94/00138

Category*	Citation of document, with indication, where appropriate of the relevant passages	Relevant to Claim No.
X	US,A, 1603110 (HORTEN) 12 October 1926 (12.10.26) Whole document	1,4
X	US,A,2019922 (McLELLAN) 5 November 1935 (05.11.35) Whole document. Heating or irrigating system.	1,4
X	Derwent Abstract Accession No. 85. 215571/35, Class P13, SU 1087-119 (MUSTAF) 23 April 1984 (23.04.84) Abstract	1
X	Derwent Abstract Accession No. 90 - 258804/34, Class P13, SU 1537-185 (GOLCHENKO) 23 January 1990 (23.01.90) Abstract	1,3,4
X	Derwent Abstract Accession No. 92 - 099610/13, Class P13, J04040834 (FSK. KK) 12 February 1992 (12.02.92) Abstract	1
X Y	AU,A,20820/29 (HELSON) 8 July 1930 (08.07.30) Reticulation means able to pass more than one liquid at different times.	1,5 9
X Y	AU,B,4520/39 (112747) (KEMENY) 3 April 1941 (03.04.41) Reticulation means able to pass more than one liquid at different times	1,4,5 9
X Y	AU,B,53371/59 (236313) (FMC CORPORATION) 7 April 1960 (07.04.60) Reticulation means able to pass more than one liquid at different times. Also valved outlets.	1,2,4 10
X Y	AU,A,15403/70 (FMC CORPORATION) 25 November 1971 (25.11.71) Reticulation means able to pass more than one liquid at different times. Also actuator means to open or close selected nozzles.	1,2,4 9,10
X Y	US,A,3578245 (BROCK) 11 May 1971 (11.05.71) Reticulation means able to pass more than one liquid at different times. Also actuator means to open or close selected nozzles.	1,2,4 9
X	GB 298876 (MAXEN) 18 October 1928 (18.10.28) Soil sterilising by hot water/steam. Network also suitable for under ground irrigating.	1,6,8
X	CH 416199 (SAGER) 13 January 1967 (13.01.67) Soil sterilising by hot water/steam. Network suitable for different liquids.	1,5,6,8,9
X	DE 4008116 (NATIONAL AGRICULTURE RESEARCH CENTRE) 18 April 1991 (18.04.91) Soil sterilising by hot water. Network suitable for different liquids.	1,6,8
X	EP 333896 (FINK) 27 September 1989 (27.09.89) Soil sterilising by hot water/steam. Network suitable for different liquids.	1,6,8

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate of the relevant passages	Relevant to Claim No.
X	Derwent Abstract Accession No. 94 - 157310/19, Class P13, SU 1797793 (RAKOVSKI) 28 February 1993 (28.02.93) Abstract. Soil sterilising by hot water.	1,6,8
X	Patent Abstracts of Japan, C76, page 1731, JP 52-662 (KENICHI KOBAYASHI) 1 June 1967 (01.06.67) Abstract. Soil sterilising by steam.	1,8
X,Y	DE 3727291 (LIST) 2 March 1989 (02.03.89) Killing weeds with hot water.	9
X,Y	DE 3639705 (CZEPEK) 1 June 1988 (01.06.88) Killing weeds with hot water/steam.	9
P,X,Y	Derwent Abstract Accession No. 94 - 151841/19, Class P14, CA 2104760 (LANGSHAW) 25 February 1994 (25.02.94) Abstract. Killing weeds with hot water or steam.	9
X,Y	Patent Abstracts of Japan C626, Page 132, JPI - 124346 (TANADA) 17 May 1989 (17.05.89) Killing weeds with hot water.	9
X,Y	Patent Abstracts of Japan C1095, Page 63, JP 5-95753 (RYOKUEI KENSETSU K K) 20 April 1993 (20.04.93). Killing weeds with hot water.	9
P,X,Y	Patent Abstracts of Japan C1283, Page 165, JP 6-253715 (MIYAZAKI) 13 September 1994 (13.09.94). Killing weeds with hot water/steam.	9
X,Y	US,A,3830014 (BAKER) 20 August 1974 (20.08.74) Projecting hot water/steam onto vegetation.	9
X,Y	AU,A 9307/22 (HEITHERSAY) 6 March 1923 (06.03.23) Controlling pests on vegetation by spraying underside of foliage.	10

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/NZ 94/00138

## Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international search report has not established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claim Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. Claim 1 to reticulation means characterised in that more than one liquid may be passed through a pipe at different times.
2. Claim 3 to reticulation means whereby a different liquid may pass through one of two pipes reserved for that liquid.
3. Claim 7 to an enclosed space in which vegetation is cultivated.
4. Claim 8 to a method of sterilising an area of soil.
5. Claim 9 to a method of controlling vegetation on an area of vegetation or cultivation.
6. Claim 10 to a method of controlling pests on an area of vegetation or cultivation as reasoned on the extra sheet.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

Box II continued.

The international application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept. In coming to this conclusion the International Searching Authority has found that there are six inventions:

1. Claim 1 directed to reticulation means characterised by the special technical feature of comprising a pipe from a supply site to a distribution point having two or more nozzles characterised in that more than one liquid may be passed through a pipe at different times.
2. Claim 3 directed to reticulation means characterised by the special technical feature of comprising at least two pipes from one supply site to one distribution point whereby a different liquid may pass through one of the pipes reserved for that liquid.
3. Claim 7 directed to an enclosed space characterised by the special technical feature of the space being filled with an atmosphere enriched with gas and provided with one of the reticulation means as above.
4. Claim 8 to a method of sterilising an area of soil characterised by the special technical feature of passing water at a temperature around 100 degreesC and 180 degreesC through pipes of one of the reticulation means as above and into or onto the area of soil.
5. Claim 9 to a method of controlling vegetation on an area of vegetation or cultivation characterised by the special technical feature of passing hot water through pipes of one of the reticulation means as above and project a spray of hot water globules or hot water and steam onto the vegetation to be controlled.
6. Claim 10 directed to a method of controlling pests on an area of vegetation or cultivation characterised by the special technical feature of passing water either continuously or intermittently through pipes of one of the reticulation means as above and project the water over the area as a fine spray in the direction of foliage, especially the underside of said foliage.

Since the above-mentioned claims do not all share the same one of the technical features identified, a "technical relationship" between the inventions, as defined in PCT Rule 13.2 does not exist.

The feature common to all the claims of a reticulation means including a pipe from a supply site to a distribution point is known from prior art as identified in this international search report.

Accordingly the international application does not relate to one invention or to a single inventive concept.

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member	
AU	56204/80		
AU	48343/85		
AU	81666/91	CN	1059069
		JP	4104741
AU	15403/90		
US	3578245		
DE	4008116	JP	3259021
		NL	9000522
EP	333896		
DE	3727291		
DE	3639705		
CA	2104760	US	5385106
SU	1087119		
SU	1537185		
SU	1797793		
JP	01124346		
JP	5095753		
JP	6253715		
US	3830014		
JP	4040834		
JP	52000662		
END OF ANNEX			